

THE EFFECTS OF AIR POLLUTION ON HUMAN HEALTH

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ABSTRACT

Air pollution is a major environmental health problem affecting the developing and the developed countries. Air pollution occurs when the air contains gases, dust, fumes or odour in harmful amounts. That is, amounts which could be harmful to the health or comfort of humans and animals or which could cause damage to plants and materials. Air pollutants mainly occur as a result of gaseous discharges from industry and motor vehicles. There are also natural sources such as wind-blown dust and smoke from fires. Some forms of air pollution create global problems, such as upper atmosphere ozone depletion and global warming. These problems are very complex, and require international cooperative efforts to find solutions. Industry is another major contributor to air pollution in India. By introducing better technology and industrial practices which enabled compliance with standards set by Environmental protection agency(EPA). Today, EPA is providing support and direction for companies to adopt cleaner production technology and practices. An ESP, electrostatic precipitator is a particulate collection device that removes particles from a gas stream using the force of an induced electrostatic charge. the air pollutants predictions or estimations are carried out as part of Environmental Impact Assessment (EIA) studies. EPA, ESP and EIA helps us to preserve our earth from pollution.

KEYWORDS: Air Pollution, Pollutants, Global Warming, Green house gases, EPA, ESP, EIA

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INTRODUCTION

Air pollution is a gas released in a big enough quantity to harm the health of people or animals, kill plants or stop them growing properly. It also damage or disrupt some other aspect of the environment such as making buildings crumble. The substances that cause air pollution are called pollutants. Pollutants that are pumped into our atmosphere and directly pollute the air are called primary pollutants. Air pollutants mainly occur due to gaseous discharges from industry and motor vehicles. The different types of pollutants are ozone, carbon monoxide, nitrogen oxides, sulphur dioxide, lead, PM10, PM2.5, PM10-2.5. In reality, air pollution occurs when any sort of contaminant is introduced into the atmosphere, thereby disrupting the chemical composition of atmosphere. The most obvious of these contaminants is carbon dioxide, which is frequently cited as the most pervasive “greenhouse gas” in the Earth’s atmosphere. The effects of air pollution on health are very complex as there are many different sources and their individual effects vary from one to the other. It is not only the ambient air quality in the cities but also the indoor air quality in the rural and the urban areas that are causing concern. In fact in the developing world the highest air pollution exposures occur in the indoor environment. Air pollutants that are inhaled have serious impact on human health affecting the lungs and the respiratory system; they are also taken up by the blood and pumped all round the body. These pollutants are also deposited on soil, plants, and in the water, further contributing to human exposure.

This paper describes the sources of various pollutants in the air and explains how pollutions can be reduced.

SOURCES OF AIR POLLUTION

Air pollutants consist of gaseous pollutants, odours, and Suspended Particulate Matter (SPM) such as dust, fumes, mist, and smoke. The concentration of these in and near the urban areas causes severe pollution to the surroundings. The largest sources of human-created air pollution are energy generation, transportation, and industries that use a great deal of energy sources. Depending on their source and interactions with other components of the air, they can have different chemical compositions and health impacts. Open burning in agriculture produces Suspended particulate matter, carbon monoxide, volatile organic compounds. Crude oil and gas production in Coal mining and Stone Quarrying cause Suspended particulate matter, sulphur dioxide, oxides of nitrogen, volatile organic compounds. Production of Electricity in Power generation form a source for the pollutants Suspended particulate matter, sulphur dioxide, oxides of nitrogen, carbon monoxide, volatile organic compounds, sulphur trioxide, lead. Fires are another major source of air pollution and can lead to severe problems if the smoke is inhaled for a period of time. These fires can either be forest fires, oil well fires, burning of leaves in the backyard or as in the case of rural areas, large-scale burning of agricultural waste. Other sources include industries and power plants located in these areas.

IMPACT OF AIR POLLUTION ON HEALTH

People are aware of the damage done to the atmosphere due to industrialization. The SPM levels increased manifold and resulted in over 4000 deaths. Indoor air pollution can be particularly hazardous to health as it is released in close proximity to people. It is stated that a pollutant released indoors is many times more likely to reach the lung than that released outdoors. In the developing countries a fairly large portion of the population is dependent on biomass for their energy requirements. These include wood, charcoal, agricultural residue, and animal waste. Open fires used for cooking and heating are commonly found in the household both in the rural and the urban areas. The stove is often at floor level, adding to the risk of accident and the hygiene factor. In addition, they are often not fitted with a chimney to remove the pollutants. In such households the children and women are most likely to be affected, as they are the group that spends more time indoors. The main pollutant in this environment is the SPM. In fact, death due to indoor air pollution, mainly particulate matters, in the rural areas of India are one of the highest in the world. Many of the deaths are due to acute respiratory infections in children; others are due to cardiovascular diseases, lung cancer, and chronic respiratory diseases in adults. If emissions are high and ventilation is poor, household use of coal and biomass can severely affect the indoor air quality.

HEALTH IMPACT OF SPECIFIC AIR POLLUTANTS

Some of these gases can seriously and adversely affect the health of the population and should be given due attention by the concerned authority. The gases mentioned below are mainly outdoor air pollutants but some of them can and do occur indoor depending on the source and the circumstances.

- **Tobacco Smoke:** Tobacco smoke generates a wide range of harmful chemicals and is a major cause of ill health, as it is known to cause cancer, not only to the smoker but affecting passive smokers too. It is well-known that smoking affects the passive smoker (the person who is in the vicinity of a smoker and is not himself/herself a smoker) ranging from burning sensation in the eyes or nose, and throat irritation, to cancer, bronchitis, severe asthma, and a decrease in lung function.

- **Biological Pollutants:** These are mostly allergens that can cause asthma, high fever, and other allergic diseases.
- **Volatile Organic Compounds:** Volatile compounds can cause irritation of the eye, nose and throat. In severe cases there may be headaches, nausea, and loss of coordination. In the longer run, some of them are suspected to cause damage to the liver and other parts of the body.
- **Formaldehyde:** Exposure causes irritation to the eyes, nose and may cause allergies in some people.
- **Lead:** Prolonged exposure can cause damage to the nervous system, digestive problems, and in some cases cause cancer. It is especially hazardous to small children.
- **Radon:** A radioactive gas that can accumulate inside the house, it originates from the rocks and soil under the house and its level is dominated by the outdoor air and also to some extent the other gases being emitted indoors. Exposure to this gas increases the risk of lung cancer.
- **Ozone:** Exposure to this gas makes our eyes itch, burn, and water and it has also been associated with increase in respiratory disorders such as asthma. It lowers our resistance to colds and pneumonia.
- **Oxides of Nitrogen:** This gas can make children susceptible to respiratory diseases in the winters.
- **Carbon Monoxide:** CO (carbon monoxide) combines with haemoglobin to lessen the amount of oxygen that enters our blood through our lungs. The binding with other haeme proteins causes changes in the function of the affected organs such as the brain and the cardiovascular system, and also the developing foetus. It can impair our concentration, slow our reflexes, and make us confused and sleepy.
- **Sulphur Dioxide:** SO₂ (sulphur dioxide) in the air is caused due to the rise in combustion of fossil fuels. It can oxidize and form sulphuric acid mist. SO₂ in the air leads to diseases of the lung and other lung disorders such as wheezing and shortness of breath. Long-term effects are more difficult to ascertain as SO₂ exposure is often combined with that of SPM.
- **SPM (Suspended Particulate Matter):** Suspended matter consists of dust, fumes, mist and smoke. The main chemical component of SPM that is of major concern is lead, others being nickel, arsenic, and those present in diesel exhaust. These particles when breathed in, lodge in our lung tissues and cause lung damage and respiratory problems. The importance of SPM as a major pollutant needs special emphasis as a) it affects more people globally than any other pollutant on a continuing basis; b) there is more monitoring data available on this than any other pollutant; and c) more epidemiological evidence has been collected on the exposure to this than to any other pollutant.

GLOBAL WARMING AN IMPACT OF AIR POLLUTION

Global Warming is the increase of Earth's average surface temperature due to effect of greenhouse gases, such as carbon dioxide emissions from burning fossil fuels or from deforestation, which trap heat that would otherwise escape from Earth. This is a type of greenhouse effect[4]. The most significant greenhouse gas is actually water vapour, not something produced directly by humankind in significant amounts. However, even slight increases in atmospheric levels of carbon dioxide (CO₂) can cause a substantial increase in temperature.

ENVIRONMENTAL PROTECTION ADMINISTRATION (EPA)

The EPA (Environmental Protection Administration) of Chennai runs Chennai Air Quality Monitoring Network (CAQMN) which is composed of several air quality monitoring on various stations to automatically collect and monitor air quality every week. More stations are set up in the area where more industrials locate in the area, thus possibly have higher air pollution. Five types of the priority pollutants are recorded: PMIO (suspended particulate), SO₂ (sulphur dioxides), NO₂ (nitrogen dioxide), CO (carbon monoxide), and O₃ (ozone). The EPA also maintains a Web site for publishing archived and real-time pollutant information and forecasting. In this study, due to the consideration of completeness in data several factors from input data, such as the data length, scale, transform, etc., can cause different analysis results. For instance, the homogeneous regions could be varied when the scale of temporal data is changed from small scale (e.g., hourly, daily, etc.) to large scale (e.g., monthly, seasonally, or annually). The selection of an appropriate scale is dependent on the application purpose. However, to support the short-term and long-range plans in air pollution management, everyone need to understand the impacts of scales in cluster analysis. Motor vehicles have been closely identified with increasing air pollution levels in urban centers of the world. Besides substantial CO₂ emissions, significant quantities of CO, HC, NO_x, SPM and other air toxins are emitted from these motor vehicles in the atmosphere, causing serious environmental and health impacts.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Most of the air pollutants predictions or estimations are carried out as part of Environmental Impact Assessment (EIA) studies. Environmental impact assessment (EIA) is the formal process used to predict the environmental consequences (positive or negative) of a plan, policy, program, or project prior to the decision to move forward with the proposed action. Formal impact assessments may be governed by rules of administrative procedure regarding public participation and documentation of decision making, and may be subject to judicial review. An impact assessment may propose measures to adjust impacts to acceptable levels or to investigate new technological solutions. The purpose of the assessment is to ensure that decision makers consider the environmental impacts when deciding whether or not to proceed with a project. The International Association for Impact Assessment (IAIA) defines an environmental impact assessment as the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made[1]. EIAs are unique in that they do not require adherence to a predetermined environmental outcome, but rather they require decision makers to account for environmental values in their decisions and to justify those decisions in light of detailed environmental studies and public comments on the potential environmental impacts[2].

ELECTROSTATIC PRECIPITATOR (ESP)

An electrostatic precipitator is a particulate collection device that removes particles from a gas stream using the force of an induced electrostatic charge[3]. Electrostatic precipitators are highly efficient filtration devices that operate at a very low pressure drop, and can easily remove fine particulate matter such as dust and smoke from the air stream. In contrast to wet scrubbers and fabric filters, which apply energy directly to the flowing fluid medium, an ESP applies energy only to the particulate matter being collected and therefore is very efficient in its consumption of energy in the form of electricity.

ESP Advantages

There are various advantages of ESP[5]. They are

- ESPs are very efficient (up to 99% efficiency), even for small particulates
- They are generally more economical than other particulate control devices: Operating costs are reduced by low energy consumption, minimal maintenance requirements and reduced cost on spare parts
- Can be designed to handle wet and dry gas compositions for a wide range of gas temperatures
- Can handle large volumes of gas flow with low pressure drop

SOLUTIONS FOR AIR POLLUTION

Air pollution means different problems at different scales. Solving a problem like passive smoking how one person's cigarette smoke can harm other people's health is very different to tackling a problem like global warming, though both involve air pollution and they do have some things in common both problems, for example, require us to think about how our behavior can affect other people in the short and long term and to act more considerately. Generally, air pollution is tackled by a mixture of technological solutions, laws and regulations, and changes in people's behaviour.

- **Use Public Mode of Transportation:** Encourage people to use more and more public modes of transportation to reduce pollution.
- **Conserve Energy:** Switch off fans and lights when you are going out. Large amount of fossil fuels are burnt to produce electricity. Save the environment from degradation by reducing the amount of fossil fuels to be burned.
- **Understand the Concept of Reduce, Reuse and Recycle:** Do not throw away items that are of no use to you. In fact reuse them for some other purpose.
- **Emphasis on Clean Energy Resources:** Clean energy technologies like solar, wind and geothermal are on high these days. Governments of various countries have been providing grants to consumers who are interested in installing solar panels for their home. This will go a long way to curb air pollution.
- **Use Energy Efficient Devices:** CFL lights consume less electricity as against their counterparts. They live longer, consume less electricity, lower electricity bills and also help you to reduce pollution by consuming less energy.

TECHNOLOGICAL SOLUTIONS

It's very easy to criticize power plants, factories, and vehicles that polluting gases into the atmosphere, but people are polluting. Solving air pollution is also a challenge because many people have a big investment in the status. It's easier for car makers to keep on making gasoline engines than to develop electric cars or ones powered by fuel cells that produce less pollution. The world has thousands of coal-fired power plants and hundreds of nuclear power stations and, again, it's easier to keep those going than to create an entirely new power system based on solar panels, wind turbines, and other forms of renewable energy. Growing awareness of problems such as air pollution and global warming is slowly forcing a shift to cleaner technologies, but the world remains firmly locked in its old, polluting ways. The following systems are used to minimize the pollution.

- **Catalytic Filter Bags:** Remove multiple gaseous compounds and dust in a one step process.
- **Coromax Pulse System:** Reduces high resistivity dust emissions in the industry.
- **Fabric Filters:** High particulate removal meeting all emission regulations.
- **Electrostatic Precipitators:** High reliability and low operational costs.
- **Hybrid Filters:** Cost-effective solution to upgrade ESP to improve emission performance.
- **Nuisance Dust Collectors:** Nuisance dust collectors for secondary dedusting.
- **Gas Suspension Absorber:** High level of SO₂, mercury and HCl removal efficiency
- **Low-NO_x in-Line Calciner:** Reduces the thermal NO_x generated in the kiln.
- **D-SO_x Cyclone:** 25-30% D-SO_x reduction without reagents.
- **Selective Non-Catalytic Reduction:** Reduces NO_x with ammonia injection.

AIR QUALITY INDEX

AQI(Air Quality Index) is an indicator of air quality, based on air pollutants that have adverse effects on human health and the environment. The pollutants are ozone, fine particulate matter, nitrogen dioxide, carbon monoxide, sulphur dioxide and total reduced sulphur compounds. The AQI consists of 6 categories, The Ambient Air Quality Standards for around Chennai reports that the safe limit for ozone is 100 micrograms per m³ and the safe AQI value set is also 100. Therefore, the AQI itself can, indirectly, be used to measure ozone concentration in Chennai. Recent technological developments in the miniaturization of electronics and wireless communication technology have led to the emergence of Environmental Sensor Networks (ESN). These will greatly enhance monitoring of the natural environment and in some cases open up new techniques for taking measurements or allow previously impossible deployments of sensors. Wireless sensor network Air Pollution Monitoring System (WAPMS) is an example of such ESN. Air Quality Index (AQI) is used in WAPMS[10].

Table 1: AQI Categories Description

AQI Levels of Health Concern	Numerical Value	Meaning
Good	0 - 50	Air quality is considered satisfactory and air pollution poses little or no risk.
Moderate	51 - 100	Air Quality is acceptable.
Unhealthy for sensitive groups	101 - 150	Members of sensitive groups may experience health effects.
Unhealthy	150 – 200	Every one affected, sensitive groups may experience more serious health effects.
Very Unhealthy	200 – 300	Health alert everyone may experience more serious Health effects.
Hazardous	300 – 500	Health warning of Emergency conditions. The entire population is more likely to be affected.

CONCLUSIONS

Air pollution play hazardous role in the health of the humans and plants. Solutions for air pollution are discussed briefly. The systems like EPA (Environmental Protection Administration), EIA (Environmental Impact Assessment) and ESP (Electrostatic Precipitator) are used in reducing the air pollution. The effects of air pollution on health are very complex as there are many different sources and their individual effects vary from one to the other. It is not only the ambient air quality in the cities but also the indoor air quality in the rural and the urban areas that are causing concern. In fact in the developing world the highest air pollution exposures occur in the indoor environment. Air pollutants that are inhaled have serious impact on human health affecting the lungs and the respiratory system; they are also taken up by the blood and pumped all round the body. These pollutants are also deposited on soil, plants, and in the water, further contributing to human exposure. Solutions for air pollution are discussed briefly. The systems like EPA (Environmental Protection Administration), EIA (Environmental Impact Assessment) and ESP (Electrostatic Precipitator) are used in reducing the air pollution.

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